

## AMENDMENTS TO THE CLAIMS

1. (Original) A method for transferring a plurality (I) of independent optical signals  
2 {S<sub>i</sub>} through an optical channel having two ends, the method comprising the  
steps of:  
4 (a) generating a plurality (I) of independent pseudorandom bit sequences (PRBSs);  
(b) modulating a preselected optical mode of the i<sup>th</sup> independent optical signal S<sub>i</sub>  
6 according to the i<sup>th</sup> independent pseudorandom bit sequence PRBS<sub>i</sub> to form an i<sup>th</sup> modulated  
optical signal MS<sub>i</sub>, where i = {1, . . . I};  
8 (c) combining a plurality (I) of the modulated optical signals {MS<sub>i</sub>} to form an  
optical multiplex signal;  
10 (d) transmitting the optical multiplex signal through the optical channel from one end  
to the other end;  
12 (e) modulating the preselected optical mode of the optical multiplex signal according  
to the i<sup>th</sup> pseudorandom bit sequence PRBS<sub>i</sub> to form an i<sup>th</sup> modulated multiplex signal MMS<sub>i</sub>; and  
14 (f) passing the i<sup>th</sup> modulated multiplex signal MMS<sub>i</sub> through a mode filter, whereby  
the independent optical signal S<sub>i</sub> is recovered.

2. (Original) The method of claim 1 wherein the preselected optical mode comprises  
2 an optical polarization mode.

3. (Original) The method of claim 2 wherein the optical channel comprises an  
2 optical waveguide.

4. (Original) The method of claim 3 wherein the optical channel comprises a fiber  
2 optical channel.

5. (Original) The method of claim 2 wherein the optical channel comprises free  
2 space.

6. (Original) The method of claim 5 wherein the plurality (I) of independent PRBSs  
2 are mutually orthogonal.

7. (Original) The method of claim 2 wherein the plurality (I) of independent PRBSs  
2 are mutually orthogonal.

8. (Original) The method of claim 1 wherein the optical channel comprises an  
2 optical waveguide.

9. (Original) The method of claim 8 wherein the plurality (I) of independent PRBSs  
2 are mutually orthogonal.

10. (Original) An apparatus for transferring a plurality (I) of independent optical  
2 signals  $\{S_i\}$  through an optical channel having two ends, the apparatus comprising:

a first pseudorandom bit sequence (PRBS) generator for generating a plurality (I) of  
4 independent PRBSs;

a plurality (I) of electro-optical modulators each coupled to the PRBS generator and  
6 disposed for modulating the polarization mode of the  $i^{\text{th}}$  optical signal  $S_i$  according to the  $i^{\text{th}}$   
pseudorandom bit sequence PRBS $_i$  to form a modulated optical signal MS $_i$ , where  $i = \{1, \dots, I\}$ ;

8 an optical combiner disposed at one end of the optical channel for combining a plurality  
(I) of the modulated optical signals  $\{MS_i\}$  to form an optical multiplex signal for transmission  
10 through the optical channel;

at least one electro-optical modulator coupled to the PRBS generator and disposed at the  
12 other end of the optical channel for modulating the polarization mode of the optical multiplex  
signal according to the  $i^{\text{th}}$  pseudorandom bit sequence PRBS $_i$  to form an  $i^{\text{th}}$  modulated multiplex  
14 signal MMS $_i$ ; and

a polarized filter disposed at the other end of the optical channel for filtering the  $i^{\text{th}}$   
16 modulated multiplex signal MMS $_i$ , whereby the independent optical signal  $S_i$  is recovered.

11. (Original) The apparatus of claim 10 further comprising:

2 a second PRBS generator disposed at the other end of the optical channel; and

correlator means for correlating the PRBSs from the second PRBS generator with the  
4 PRBSs from the first PRBS generator.

12. (Original) The apparatus of claim 11 further comprising:

an optical splitter disposed at the other end of the optical channel for splitting the optical multiplex signal to form a plurality (I) of optical multiplex signal copies  $\{MSC_i\}$ ;

a plurality (I) of electro-optical modulators, each coupled to the second PRBS generator and disposed at the other end of the optical channel for modulating the polarization mode of the  $i^{\text{th}}$  multiplex optical signal copy  $MSC_i$  according to the  $i^{\text{th}}$  pseudorandom bit sequence  $PRBS_i$  to form a modulated multiplex signal  $MMS_i$ ; and

a plurality (I) of polarized filters, each disposed at the other end of the optical channel for filtering the  $i^{\text{th}}$  modulated multiplex signal  $MMS_i$ , whereby the plurality (I) of independent optical signal  $\{S_i\}$  are recovered.

13. (Original) The apparatus of claim 12 wherein the optical channel comprises an optical waveguide.

14. (Original) The apparatus of claim 13 wherein the optical channel comprises a fiber optical channel.

15. (Original) The apparatus of claim 11 wherein the optical channel included mode distortion and at least one independent optical signal  $S_p$  is transmitted through the optical channel, the apparatus further comprising:

distortion recovery means for recovering the optical channel mode distortion from the independent optical signal  $S_p$ .

16. (Original) The apparatus of claim 15 wherein the optical channel comprises free space.

17. (Original) The apparatus of claim 10 wherein the optical channel comprises an optical waveguide.

18. (Original) The apparatus of claim 17 wherein the optical channel comprises a fiber optical channel.

19. (Original) The apparatus of claim 10 wherein the optical channel comprises free  
2 space.

20. (Original) The apparatus of claim 10 wherein the plurality (I) of independent  
2 PRBSs are mutually orthogonal.

21. (Currently Amended) An apparatus for generating, from a plurality (I) of  
2 independent optical signals  $\{S_i\}$ , an optical multiplex signal suitable for transmission into an  
optical channel, the apparatus comprising:

4 a pseudorandom bit sequence (PRBS) generator for generating a plurality (I) of  
independent PRBSs;

6 a plurality (I) of electro-optical modulators each coupled to the PRBS generator and  
disposed for modulating the polarization mode of the  $i^{\text{th}}$  optical signal  $S_i$  according to the  $i^{\text{th}}$   
8 pseudorandom bit sequence  $\text{PRBS}_i$  to form a modulated optical signal  $\text{MS}_i$ , where  $i = \{1, \dots, I\}$ ,  
thereby producing a plurality of mutually-orthogonal polarization-mode modulated optical  
10 signals  $\{\text{MS}_i\}$ ; and

an optical combiner disposed at one end of the optical channel for combining a plurality  
12 (I) of the modulated optical signals  $\{\text{MS}_i\}$  to form the optical multiplex signal for transmission  
through the optical channel.

22. (Original) The apparatus of claim 21 wherein the optical channel comprises an  
2 optical waveguide.

23. (Original) The apparatus of claim 22 wherein the optical channel comprises a  
2 fiber optical channel.

24. (Original) The apparatus of claim 21 wherein the optical channel comprises free  
2 space.

25. (Original) The apparatus of claim 21 wherein the plurality (I) of independent  
2 PRBSs are mutually orthogonal.

26. (Original) An apparatus for receiving, from an optical channel, an optical  
2 multiplex signal representing a plurality (I) of independent optical signals  $\{S_i\}$  and for  
recovering therefrom an independent optical signal  $S_i$ , the apparatus comprising:

4 receiving means for accepting the optical multiplex signal from the optical channel;  
a first pseudorandom bit sequence (PRBS) generator for generating a plurality (I) of  
6 independent PRBSs;

at least one electro-optical modulator coupled to the PRBS generator for modulating the  
8 polarization mode of the optical multiplex signal according to the  $i^{\text{th}}$  pseudorandom bit sequence  
PRBS $_i$  to form an  $i^{\text{th}}$  modulated multiplex signal MMS $_i$ ; and

10 a polarized filter for filtering the  $i^{\text{th}}$  modulated multiplex signal MMS $_i$ , whereby the  
independent optical signal  $S_i$  is recovered.

27. (Original) The apparatus of claim 26 wherein a second PRBS generator is  
2 disposed at the other end of the optical channel, the apparatus further comprising:

correlator means for correlating the PRBSs from the first PRBS generator with the  
4 PRBSs from the second PRBS generator.

28. (Original) The apparatus of claim 27 further comprising:

2 an optical splitter for splitting the optical multiplex signal to form a plurality (I) of optical  
multiplex signal copies  $\{MSC_i\}$ ;

4 a plurality (I) of electro-optical modulators, each coupled to the first PRBS generator for  
modulating the polarization mode of the  $i^{\text{th}}$  multiplex optical signal copy MSC $_i$  according to the  
6  $i^{\text{th}}$  pseudorandom bit sequence PRBS $_i$  to form a modulated multiplex signal MMS $_i$ ; and

8 a plurality (I) of polarized filters for filtering the  $i^{\text{th}}$  modulated multiplex signal MMS $_i$ ,  
whereby the plurality (I) of independent optical signal  $\{S_i\}$  are recovered.

29. (Original) The apparatus of claim 28 wherein the optical channel comprises an  
2 optical waveguide.

30. (Original) The apparatus of claim 29 wherein the optical channel comprises a  
2 fiber optical channel.

31. (Original) The apparatus of claim 27 wherein the optical channel included mode distortion and at least one independent optical signal  $S_p$  is transmitted through the optical channel, the apparatus further comprising:

distortion recovery means disposed at the other end of the optical channel for recovering the optical channel mode distortion from the independent optical signal  $S_p$ .

32. (Original) The apparatus of claim 31 wherein the optical channel comprises free space.

33. (Original) The apparatus of claim 26 wherein the optical channel comprises an optical waveguide.

34. (Original) The apparatus of claim 33 wherein the optical channel comprises a fiber optical channel.

35. (Original) The apparatus of claim 26 wherein the optical channel comprises free space.

36. (Original) The apparatus of claim 26 wherein the plurality (I) of independent PRBSs are mutually orthogonal.